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UNIVERSITI TUN HUSSEIN ONN MALAYSIA

**FINAL EXAMINATION
SEMESTER I
SESSION 2019/2020**

COURSE NAME : PHYSICS OF RADIOTHERAPY AND
NUCLEAR MEDICINE

COURSE CODE : BWC 40903

PROGRAMME CODE : BWC

EXAMINATION DATE : DECEMBER 2019/ JANUARY 2020

DURATION : 3 HOURS

INSTRUCTION : ANSWER ALL QUESTIONS

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THIS QUESTION PAPER CONSISTS OF FIVE (5) PAGES

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- Q1** (a) Radiation damage to mammalian cells can be divided into lethal damage, potentially lethal damage (PLD) and sublethal damage (SLD).
- (i) Determine the process of cell radiation damage in PLD via indirect action. (6 marks)
 - (ii) Describe **TWO (2)** factors that affect SLD. (2 marks)
 - (iii) Predict what would happen to deoxyribonucleic acid (DNA) sequences after undergo a lethal damage. (6 marks)
- (b) Half-value layer (HVL) is often used to describe the quality of beam radiation. Conclude the role of HVL in producing a good beam quality during Linear Accelerator (LINAC) operation. (3 marks)
- (c) Point out **THREE (3)** important factors that need to be considered while loading the cassettes for X-ray radiography in the darkroom. (3 marks)

Q2 Table Q2 shows a data for patient that treated with 6MV linear accelerator at 100 cm and using source surface distance (SSD) technique. The collimator settings is 15 x 15 cm. There is no blocking used for this treatment. The prescription states that a dose of 1200 cGy is to be delivered to a depth of 5 cm in 10 fractions.

- (i) Calculate the radiation dose at 15 cm and 20 cm. (6 marks)
- (ii) Sketch a dose distribution using SSD technique for your answer in **Q2(i)**. (6 marks)
- (iii) Predict the radiation dose at 30 cm. (3 marks)
- (iv) Give comment for your answer in **Q2(iii)**. (2 marks)
- (v) Suggest what would happen to value of percentage depth dose (PDD) if source axis distance technique (SAD) is used to treat the patient. (3 marks)

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- Q3** (a) A major development in radiation therapy is the design of immobilization devices that help the patient remains in the same position on the treatment couch.
- (i) Classify the type of immobilization devices used in radiation therapy. (2 marks)
 - (ii) Distinguish the characteristics of immobilization devices used for tumors treating at chest and head area. (4 marks)
- (b) A radiation therapy treatment charts is an important document for communication between staff regarding the details of the patient's treatment.
- (i) Identify **THREE (3)** important informations that should be include in radiation therapy treatment charts. (3 marks)
 - (ii) Based on your answer in **Q3(b)(i)**, discriminate each of the informations. (6 marks)
- (c) It is necessary for all staff to participate in the implementation and operation of the Quality Assurance (QA) program in the workplace. Elaborate on the issues that would exist if the objectives of the QA program not achieved. (5 marks)
- Q4** (a) Brachytherapy is used to treat cancers throughout the body by using temporary and permanent implant.
- (i) Differentiate the characteristics of temporary and permanent implants. (4 marks)
 - (ii) Outline the process of treatment planning in brachytherapy. (6 marks)
- (b) Acceptance tests of radiotherapy equipment are generally divided into three groups which is safety checks, mechanical checks and dosimetry measurements.
- (i) Explain the main purpose of acceptance test. (2 marks)
 - (ii) List **FIVE (5)** components in safety checks. (5 marks)
 - (iii) Discuss why mechanical checks are performed in the presence of a representative of the equipment manufacturer. (3 marks)

- Q5** (a) Amanda was paralysed from the neck down following a ruptured blood vessel in her neck. Unable to breath unaided, she was placed on a ventilator. She ask the Doctor to turn off the ventilator so she could die. Unfortunately, Doctors at the hospital refused to turn the ventilator off. Based on medical ethics,
- (i) debate why aiding in the Amanda's death goes against an ethical issues. (5 marks)
 - (ii) conclude why Amanda given a choice when making decisions regarding treatment procedures on her. (5 marks)
- (b) Zaharah had suffered a series of strokes and the only way she could be kept alive was to force feed her through a syringe. She asked the Doctor and her daughters to left her to starve until she die. She weighed less than 35 kg when she died in August 2019.
- (i) Conclude what would you do if you were one of the health care workers. (5 marks)
 - (ii) In this case, do you think that the ends justified the means? Give your opinions based on autonomy principle. (5 marks)

-END OF QUESTIONS -

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Table Q2

Distance Dose	(Percentage Depth Dose) %PDD
D_{\max}	100
5	88
10	66
15	47
20	35

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